

NASA Global Hawk Project Overview and Future Plans



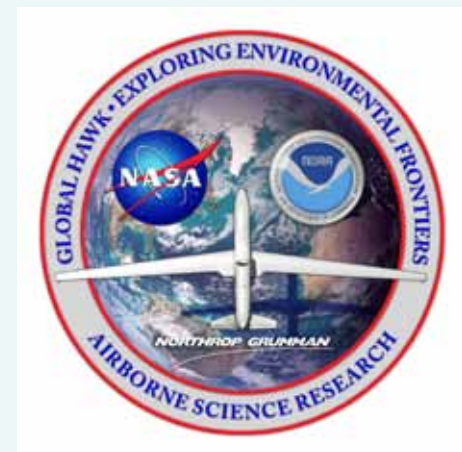
**Chris Naftel
Global Hawk Project Manager
NASA Dryden Flight Research Center
October 2011**



Presentation Content

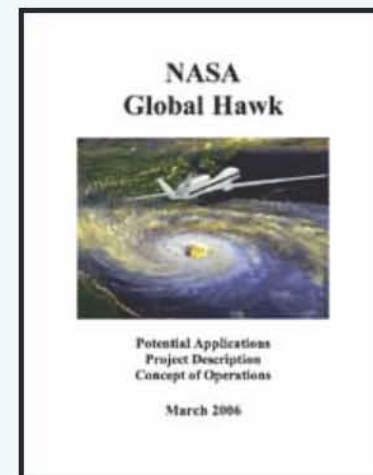
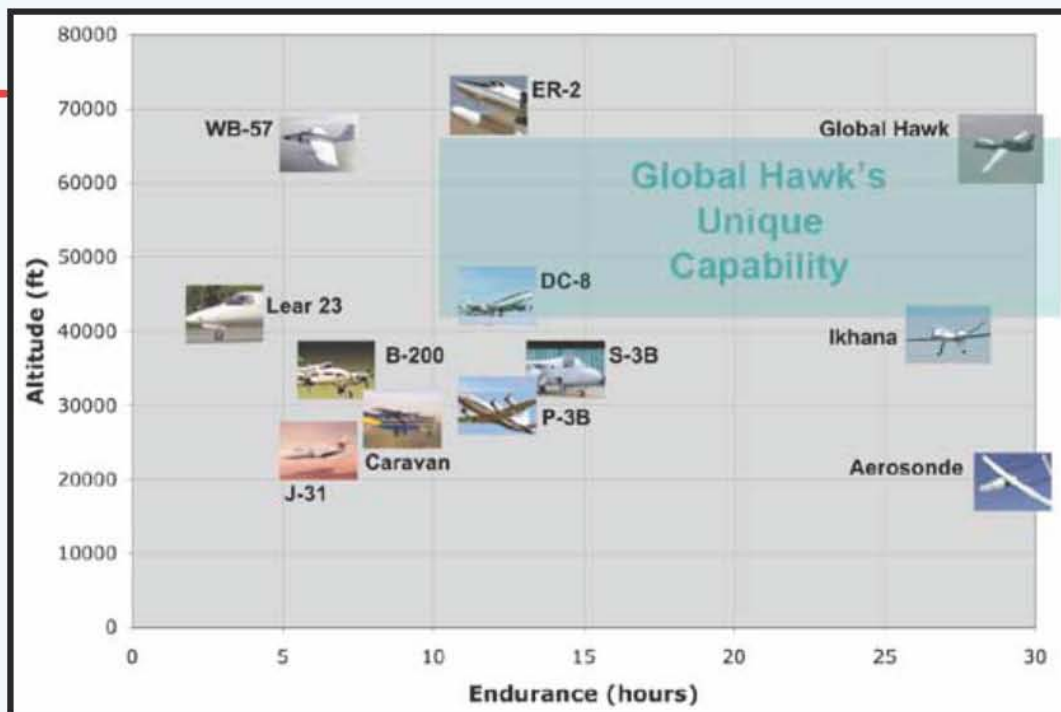
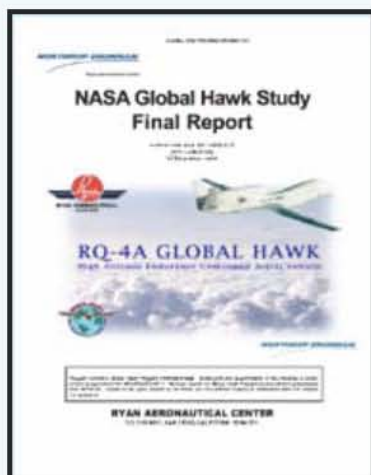


- **Why is NASA operating Global Hawks?**
- **Where is NASA Global Hawk located?**
- **How did this project get off the ground?**
- **What is needed to operate Global Hawk?**
- **How are payloads Integrated?**
- **What has been accomplished to date?**
- **What are the future plans?**

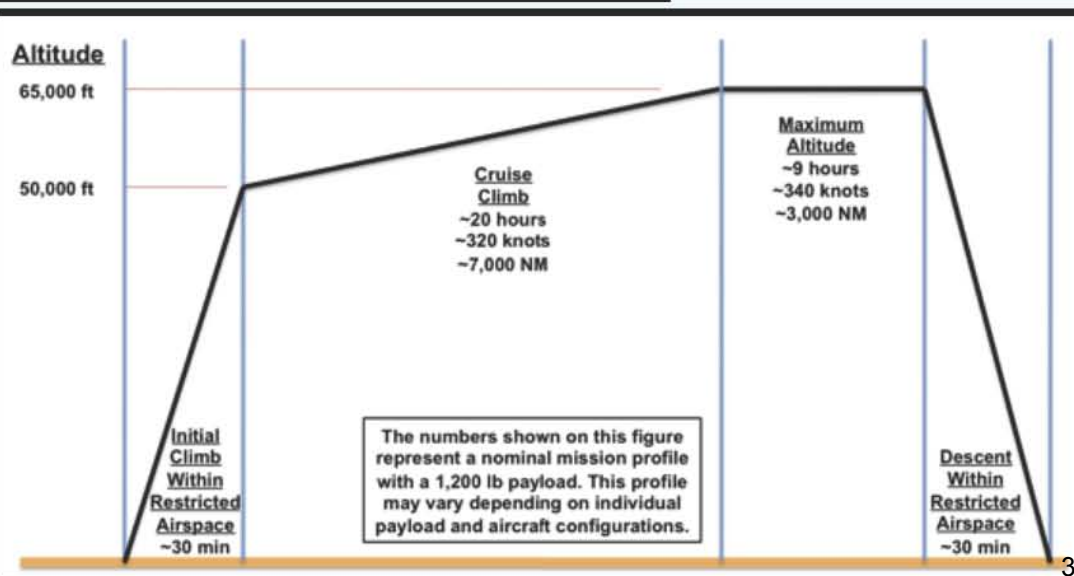




Why Global Hawk For NASA?



Endurance	> 30 hours
Range	>10,000 nmi
Service Ceiling	65,000 ft
Airspeed (55K+ ft)	335 KTAS
Payload	1,000-1,500 lb
Take-off Weight	26,750 lb
Length	44 ft
Wingspan	116 ft





Edwards Air Force Base and NASA Dryden Flight Research Center



Edwards Air Force Base

**Dryden Flight
Research Center**



NASA Dryden Aircraft Fleet

Edwards and Dryden are ~75 miles north of Los Angeles



Establishment of the NASA Global Hawk Project



- Two USAF Pre-Production Global Hawk aircraft (ACTD) were transferred to NASA in September 2007.
- A 5 year Global Hawk partnership was established in 2008 between NASA and Northrop Grumman.
- Each partner provides 50% of the start-up and yearly investment and receives 50% of the access to the aircraft.
- The Airborne Science Program of the NASA Science Mission Directorate provides the NASA funding.
- A combined NASA/Northrop Grumman team is maintaining, modifying, and operating these 2 aircraft.





NASA Global Hawk Operations Overview



Runways



Mission Staging Locations



Maintenance Hangar & Instrument Lab



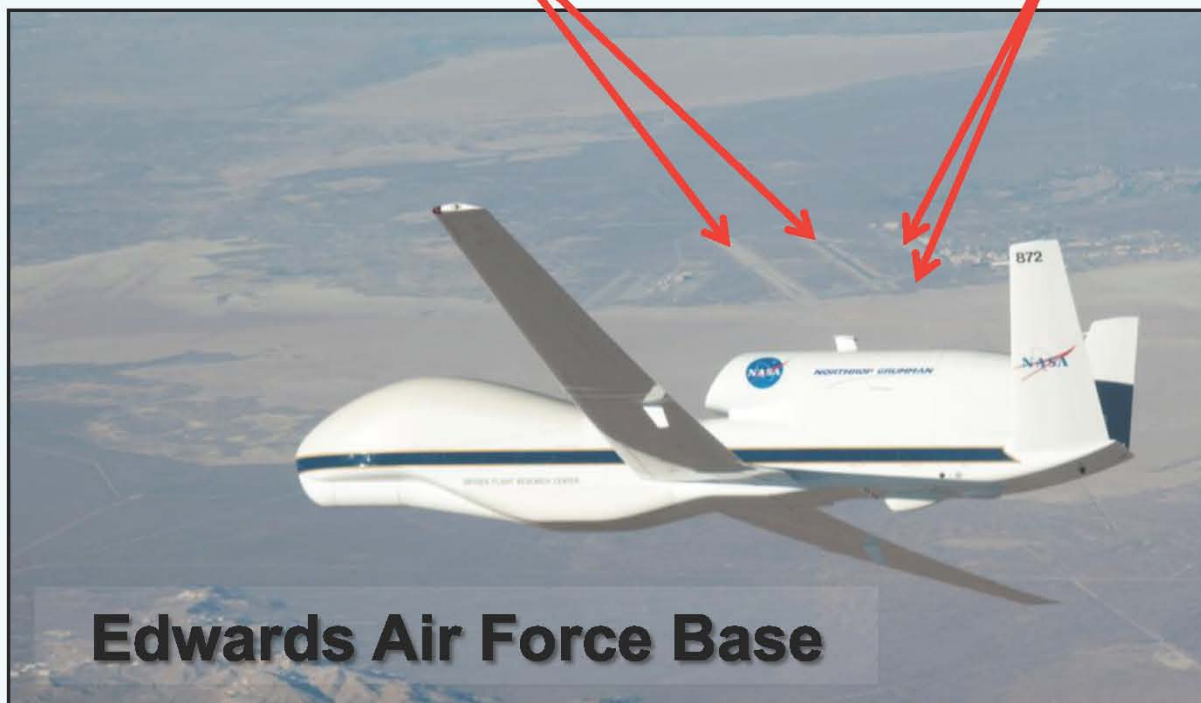
NASA Dryden Flight Research Center



Operations Center



Edwards Air Force Base

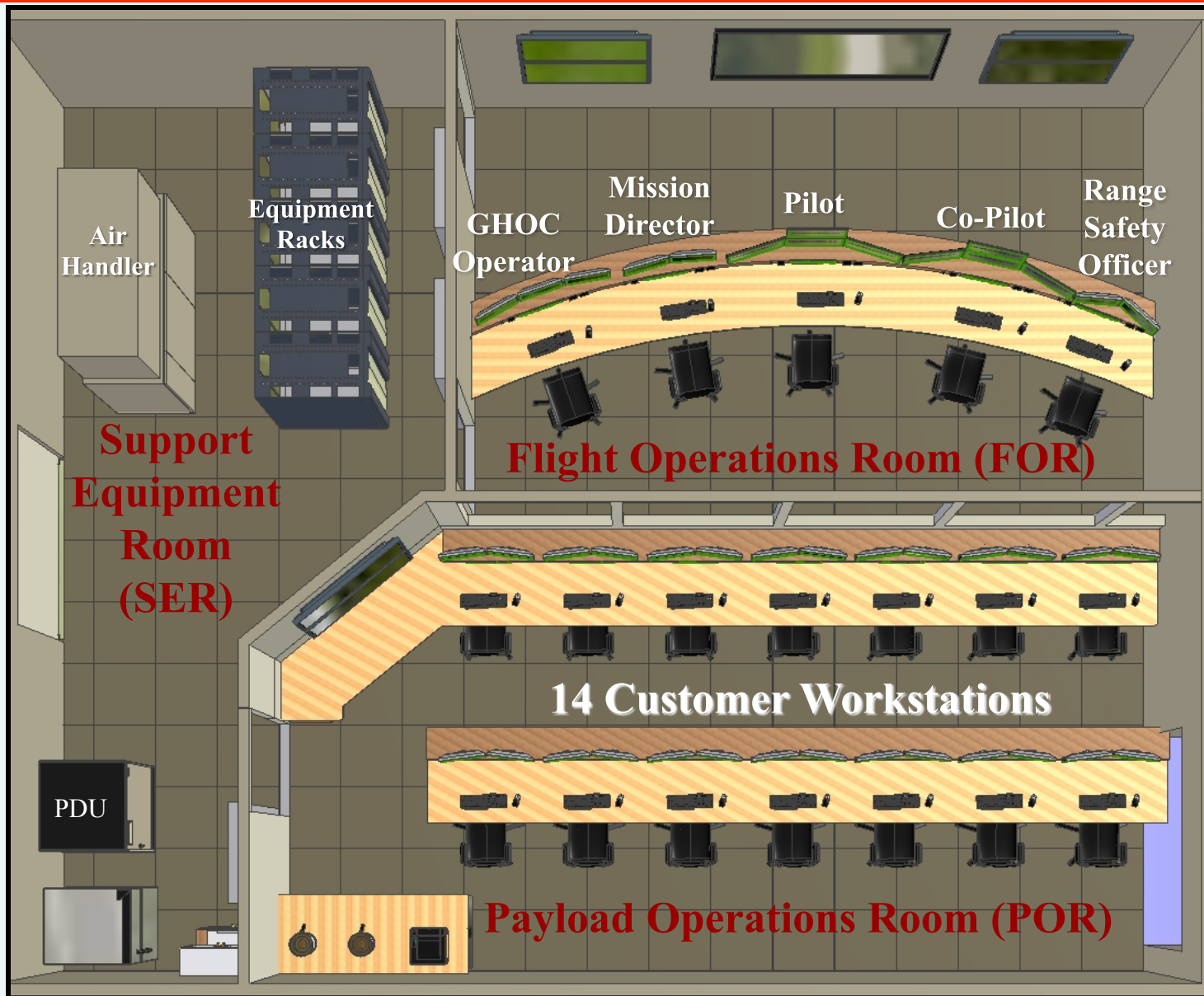




Global Hawk Operations Center (GHOC), Located at DFRC



**Facility
Entrance**



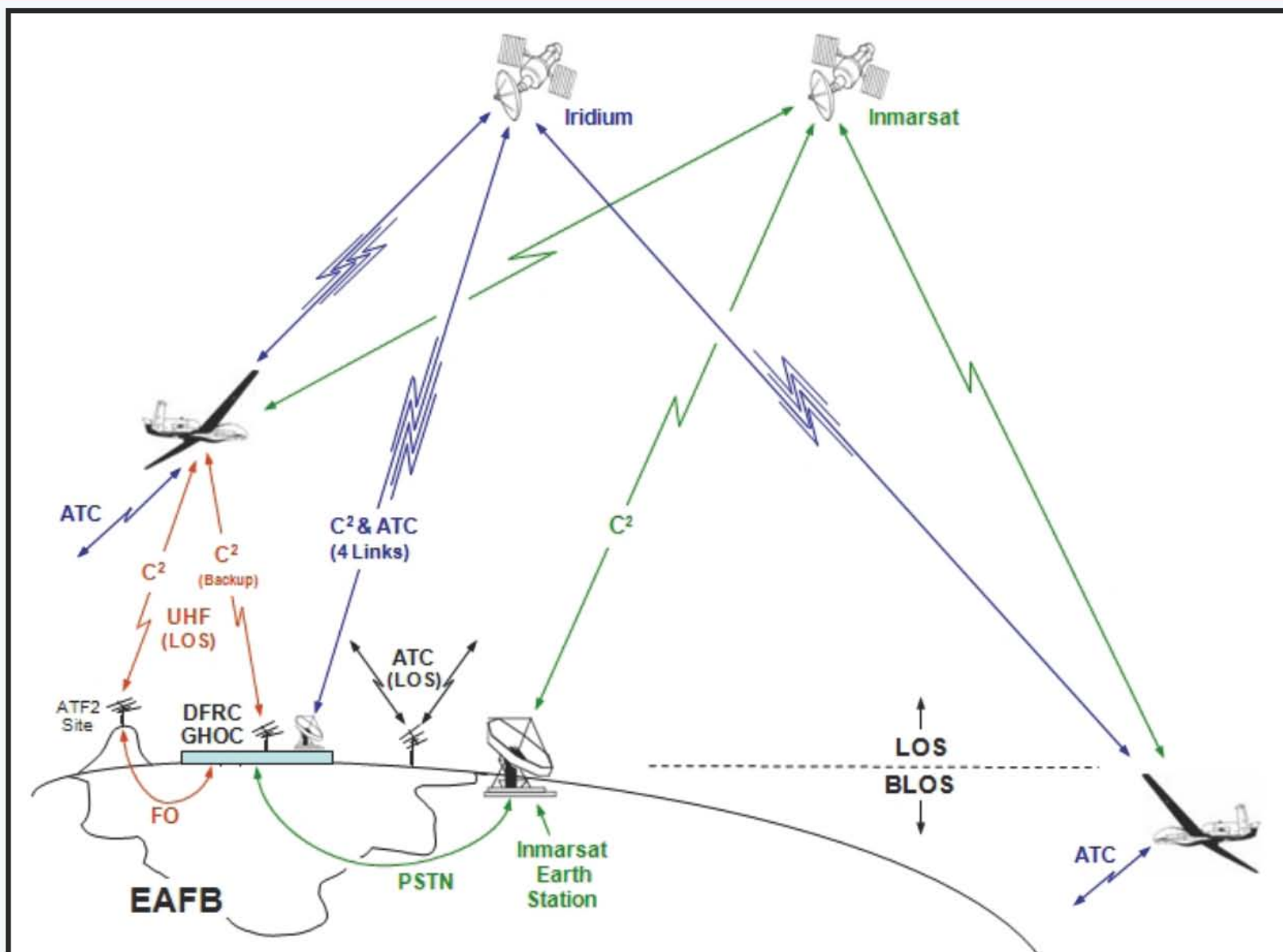


GHOC Fully Staffed During a Hurricane Mission



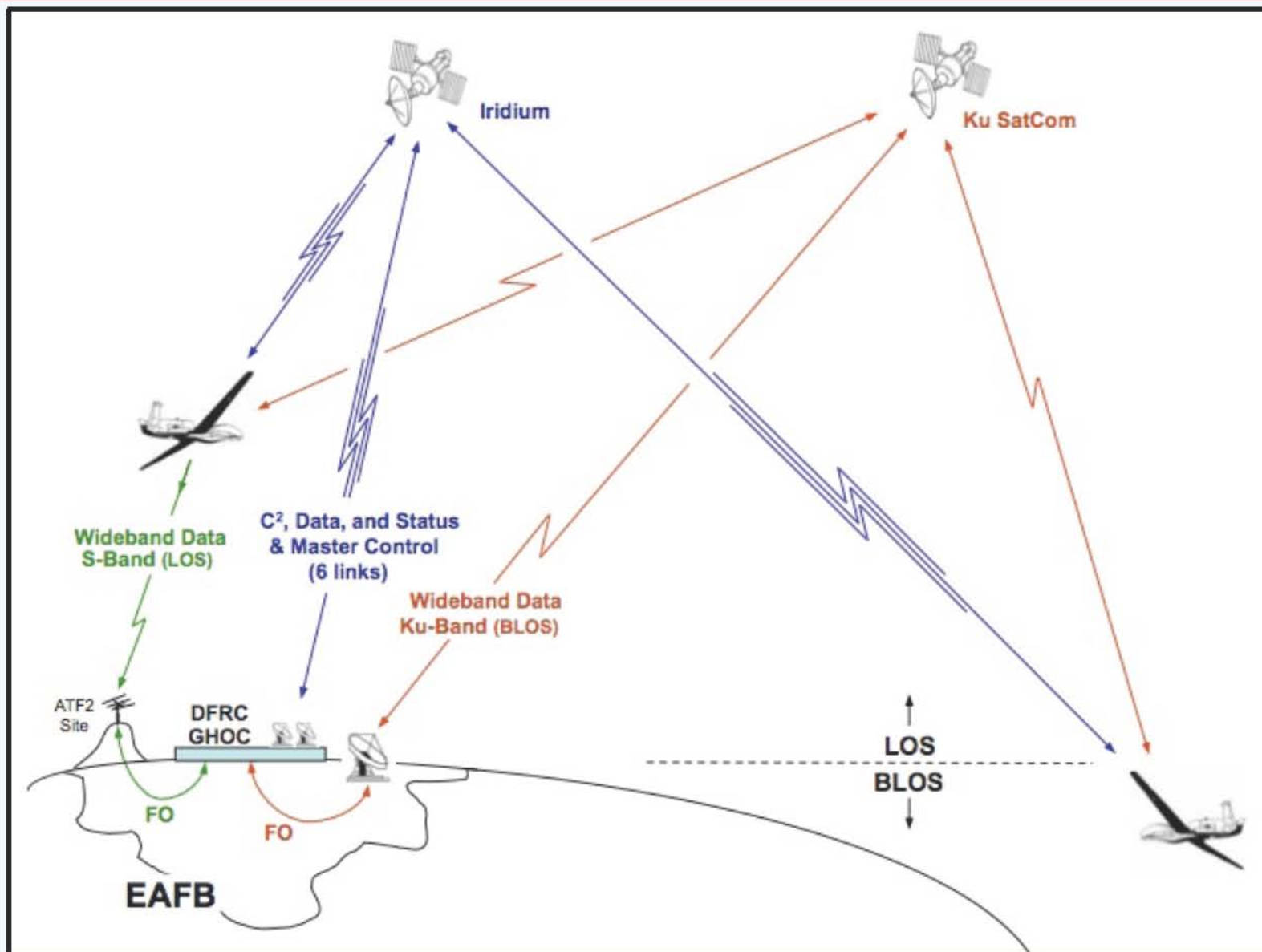


Aircraft Flight Control and Air Traffic Control Communications Architecture



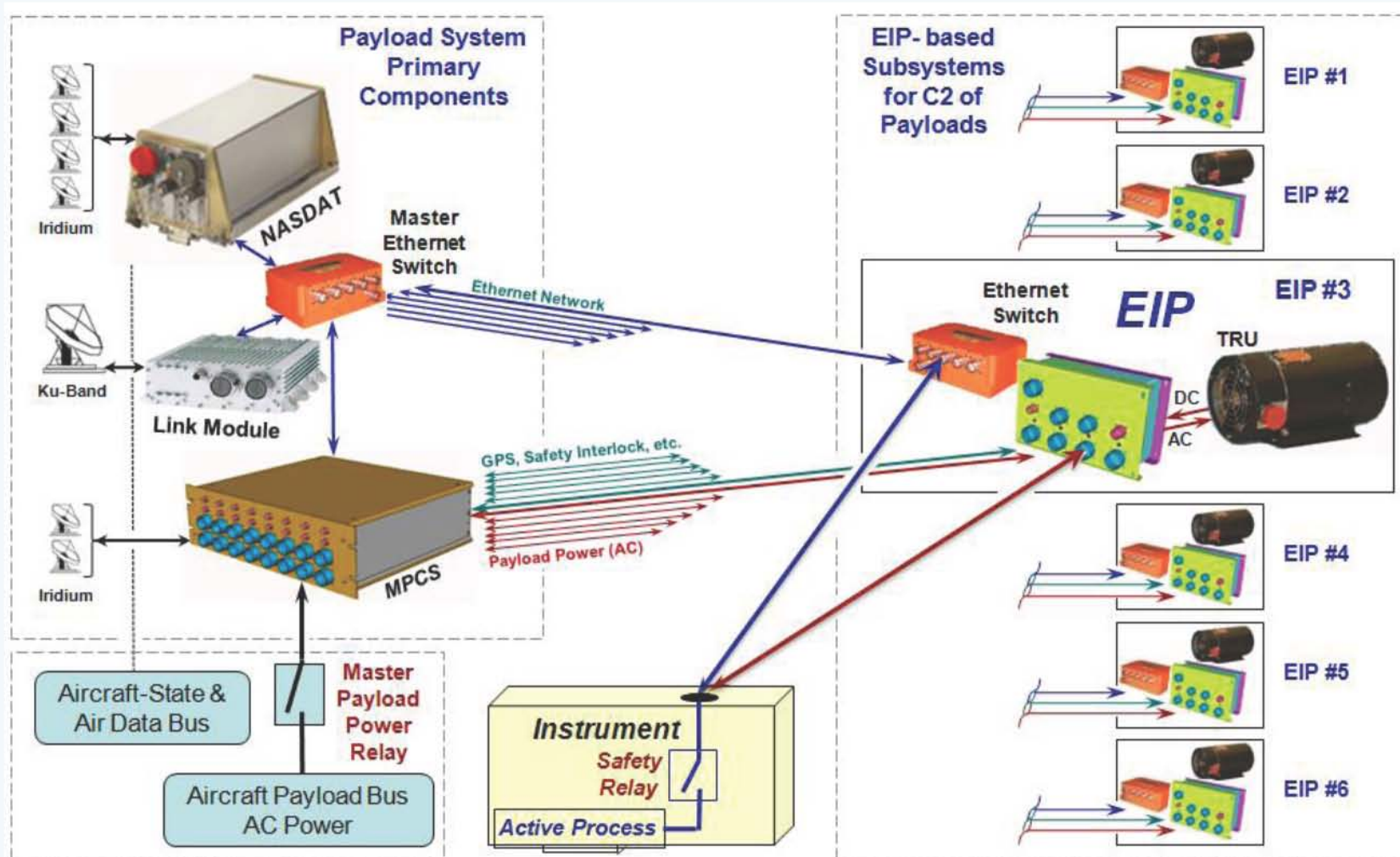


Payload Communications Architecture (Independent of Aircraft C2 and ATC)





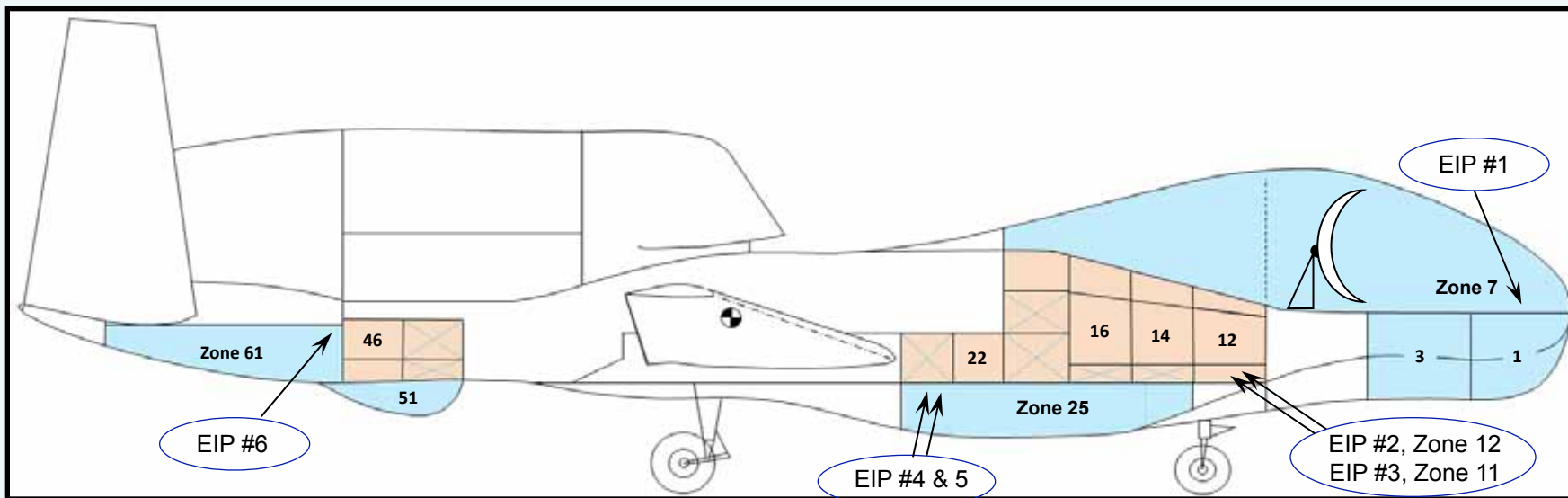
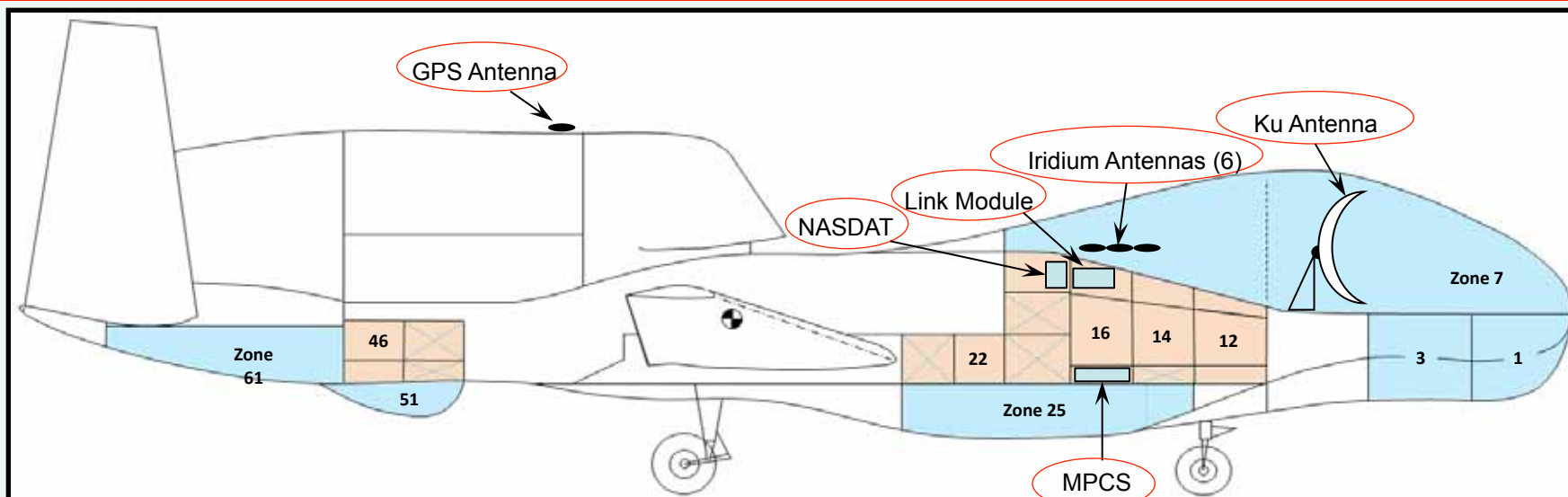
Overview of the Airborne Payload C³ System (APCS)



NASA Ames Developed and Operates this Integrated System for Global Hawk



APCS Subsystems Locations and Payload Bays





Payload Integration and Accommodations



Payload Power and Aircraft Data

Payload C² and Payload Data



Payload Integration Test Bench
(Pre-Integration Checkout)

Experiment Interface Panel & Ethernet Switch
(6 sets distributed on aircraft, each set supports up to 4 payloads)



Mounting Rails



Tail Volume



Bay Under the Nose



Pallets and Hatches



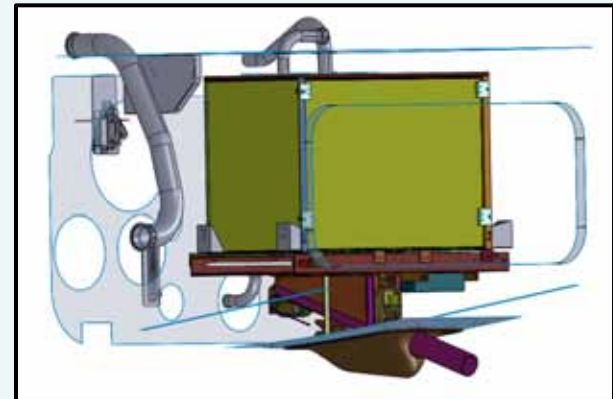
Mounting Hard Points



Payload Integration Process (1 of 2)



- **Site visit at customer's location; initial discussion of payload details and operational concept.**
- **Receipt of payload solid models and design/integration data from customer.**
- **Integration engineering (performed by DFRC and/or NGC).**
- **Avionics harness fabrication at DFRC.**
- **Fabrication and fit-check of payload mounting structure.**
- **Initial mechanical integration on aircraft.**





Payload Integration Process (2 of 2)



- **Environmental tests on payloads, as required.**
- **Electrical integration on payload test bench.**
- **Final integration on aircraft.**
- **Payload communications setup in the GHOC.**
- **Combined System Test with all aircraft and payload systems operating.**
- **Range check-out flight.**





NASA Global Hawk Flights Through March 2011



Date(s)	TN871 (AV-1)		TN872 (AV-6)		Takeoff Location	Landing Location	Flight Areas	Flight Objective
	Flt #	Duration, hr	Flt #	Duration, hr				
10/23/09			0044	4.0	EAFB	EAFB	EAFB Range	Return to flight for AV-6, Functional Check flight
10/29/09			0045	2.8	EAFB	EAFB	EAFB Range	Completion of Functional Check Flight objectives
11/4/09			0046	1.4	EAFB	EAFB	EAFB Range	Pilot Proficiency
11/9/09			0047	0.9	EAFB	EAFB	EAFB Range	Pilot Proficiency
11/9/09			0048	1.2	EAFB	EAFB	EAFB Range	Pilot Proficiency
3/3/10			0049	2.6	EAFB	EAFB	EAFB Range	Checkout flight for Payload Support System
3/5/10			0050	9.2	EAFB	EAFB	EAFB Range	Checkout flight for Payload Support System
3/11/10			0051	10.3	EAFB	EAFB	EAFB Range	Checkout flight for Payload Support System
4/2/10			0052	6.3	EAFB	EAFB	EAFB Range	GloPac Instrument check-out flight
4/7/10			0053	14.1	EAFB	EAFB	Pacific	GloPac Science Flight #1, Arctic Vortex
4/13-14/10			0054	24.4	EAFB	EAFB	Pacific	GloPac Science Flight #2, Tropics
4/23-24/10			0055	28.6	EAFB	EAFB	Pacific, Alaska, Arctic	GloPac Science Flight #3, Arctic Zone
4/30/10			0056	9.3	EAFB	EAFB	Pacific	GloPac Science Flight #4
5/27/10	0068	4.1			EAFB	EAFB	EAFB Range	Return to flight for AV-1, Functional Check flight
6/15/10	0069	0.7			EAFB	EAFB	EAFB Range	Pilot Proficiency
6/15/10	0070	0.8			EAFB	EAFB	EAFB Range	Pilot Proficiency
6/22/10	0071	0.8			EAFB	EAFB	EAFB Range	Pilot Proficiency
6/22/10	0072	1.0			EAFB	EAFB	EAFB Range	Pilot Proficiency
6/29/10	0073	4.3			EAFB	EAFB	EAFB Range	Pilot Proficiency
8/15/10			0057	6.1	EAFB	EAFB	EAFB Range	GRIP Instrument check-out flight
8/24/10			0058	2.5	EAFB	EAFB	EAFB Range	Dropsonde test flight
8/28/10			0059	15.3	EAFB	EAFB	Pacific	GRIP Science Flight #1, TD Frank
9/1-2/10			0060	24.2	EAFB	EAFB	CONUS, Gulf of Mexico, Atlantic	GRIP Science Flight #2, Hurricane Earl
9/12-13/10			0061	24.3	EAFB	EAFB	CONUS, Gulf of Mexico, Caribbean	GRIP Science Flight #3, TD AL 92
9/16-17/10			0062	25.2	EAFB	EAFB	CONUS, Gulf of Mexico	GRIP Science Flight #4, Hurricane Karl
9/23-24/10			0063	25.1	EAFB	EAFB	CONUS, Gulf of Mexico, Caribbean	GRIP Science Flight #5, TS Matthew
10/13/10	0074	1.0			EAFB	EAFB	EAFB Range	Pilot Proficiency
10/13/10	0075	1.7			EAFB	EAFB	EAFB Range	Pilot Proficiency
10/21/10	0076	0.8			EAFB	EAFB	EAFB Range	Pilot Proficiency
12/8/11			0064	1.4	EAFB	EAFB	EAFB Range	Wake Survey with King Air
1/19/11			0065	1.5	EAFB	EAFB	EAFB Range	Dropsonde 15k ft Altitude test
1/21/11			0066	5.1	EAFB	EAFB	EAFB Range	Wake Survey with Proteus
1/27/11			0067	2.4	EAFB	EAFB	EAFB Range	Dropsonde 30k ft Altitude test
2/4/11			0068	8.5	EAFB	EAFB	Pacific	Dropsonde High Altitude test
2/10-11/11			0069	20.5	EAFB	EAFB	Pacific	WISPAR Science Flight #1, Atmospheric River
3/1/11			0070	13.5	EAFB	EAFB	EAFB Range	IMMC Clearance Flight
3/3-4/11			0071	24.1	EAFB	EAFB	Pacific	WISPAR Science Flight #2, Winter Storm
3/9-10/11			0072	25.1	EAFB	EAFB	Pacific, Alaska, Arctic	WISPAR Science Flight #3, Atmospheric River, Arctic Zone
3/29/11			0073	1.0	EAFB	EAFB	EAFB Range	Pilot Proficiency
3/29/11			0074	1.1	EAFB	EAFB	EAFB Range	Pilot Proficiency
Totals	9 flts	15.2	31 flts	342.0				



Flights Outside the EAFB Airspace



NAS Flight Summary

- 13 Flights
- 310 Hours
- ~100,000 nmi

2 Certificates of Authorization

- Pacific-Alaska-Arctic
- Western Atlantic-Caribbean-Gulf of Mexico



Completed Science Campaigns



- **Global Hawk Pacific (March-April 2010)**
 - 11 instruments
 - 4 science missions, 76 hours
 - First Global Hawk Science Mission
 - Flights spanned 12 to 85 deg N Latitudes
- **Genesis and Rapid Intensification Processes (August-September 2010)**
 - 4 Instruments
 - 5 science missions, 114 hours total
 - First Global Hawk severe storm over flight
- **Winter Storm Pacific and Atmospheric Rivers (February-March 2011)**
 - 2 Instruments
 - 3 science missions, 70 hours total
 - First operational dropsonde deployment from a UAV





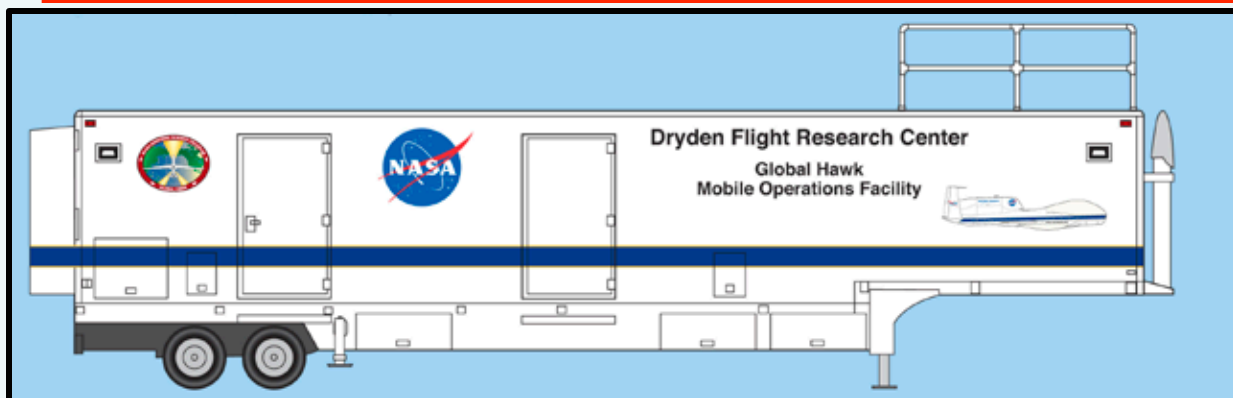
Future Plans





Capability Developments for Deployments

All Three Systems will be on-line by October 2011



Portable Aircraft Command and Control Facility

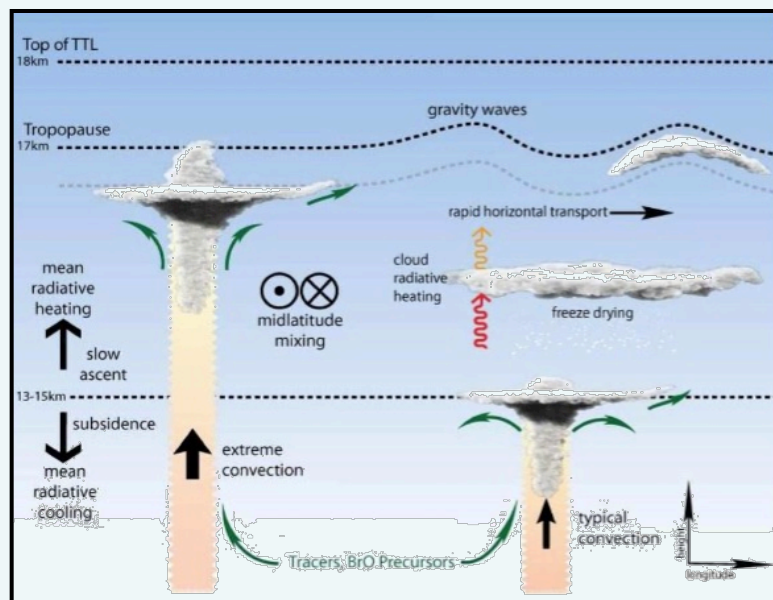


Portable Ku Ground Station, used for Payload Data

A Portable Payload Operations Facility, with extendable sides and accommodations for 14 Scientists, is in development

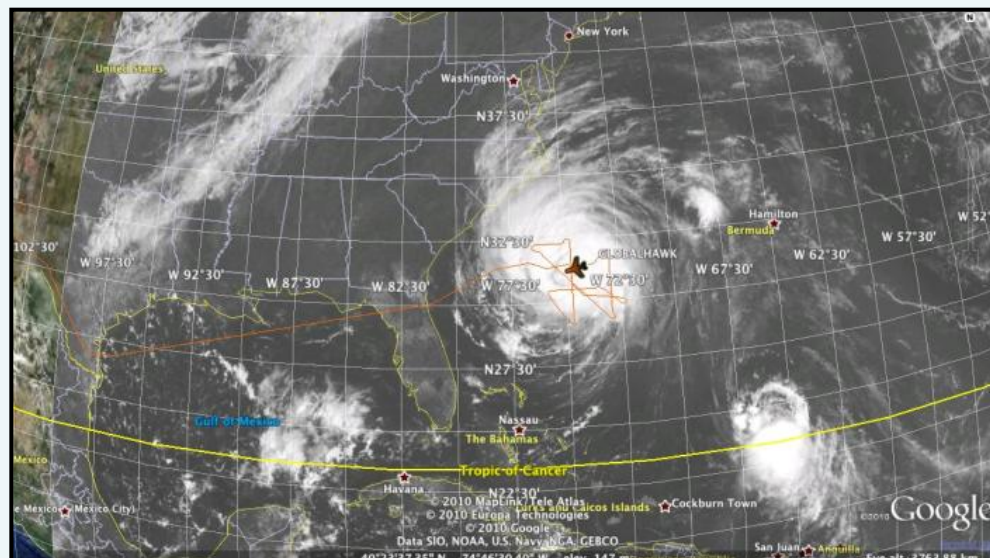


Future Missions



ATTREX (2011-2014)

Airborne Tropical TRopopause Experiment
(Base of Operations in the Western Pacific)



HS3 (2011-2014)

Hurricane and Severe Storm Sentinel
(Base of Operations in the US East Coast)

UAVSAR

Reconfigurable polarimetric L-band
SAR designed for repeat pass
deformation measurements.





Current NASA Global Hawk Fleet

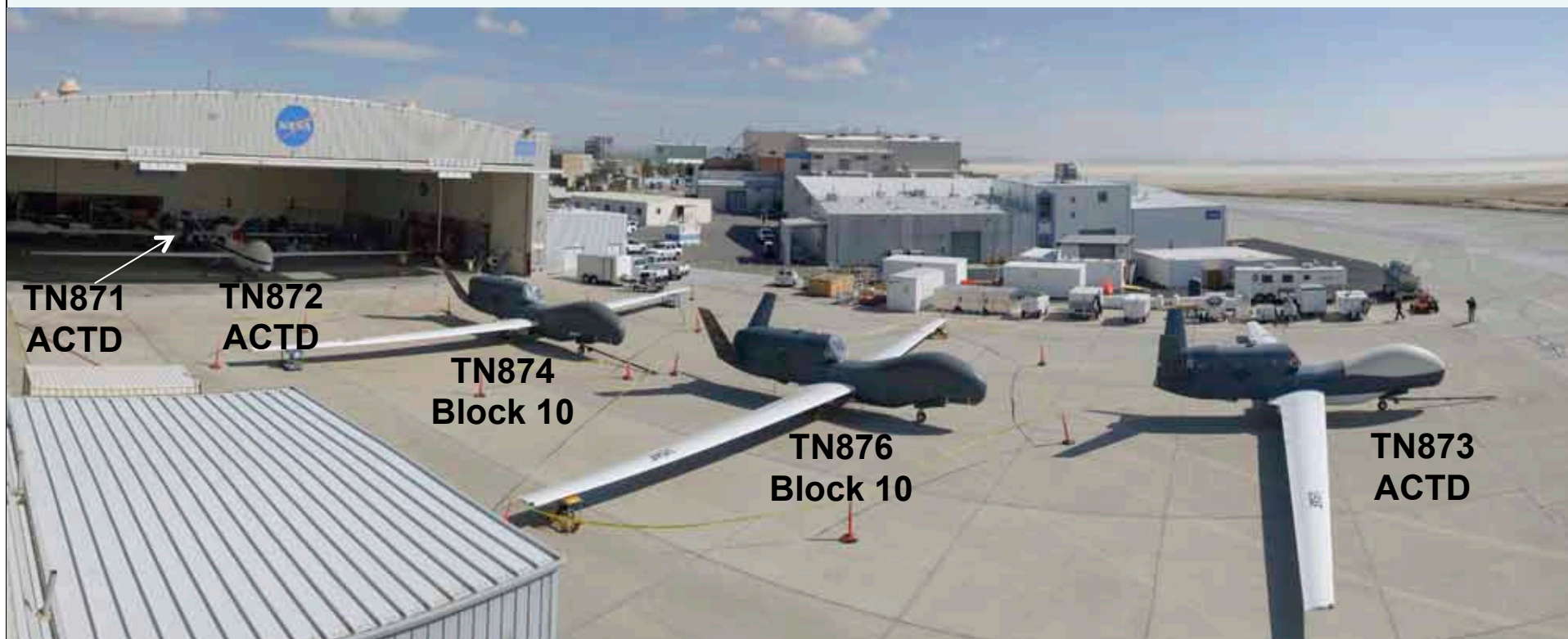


Two Operational Aircraft

TN871, TN872

Three “Spares” Aircraft

TN873, TN874, TN876





Project Summary



- **NASA Global Hawk is operational and supporting Earth science research.**
- **40 Flights have been conducted since the start of operations in October 2009, with a total of 357 flight hours.**
- **Three science campaigns have been conducted with all major objectives met.**
- **Two new multi-year science campaigns begin this year.**



HDVIS/StarDot Sat Aug 28 23:08:01 2010 Flight -GLOPAC_4
Exposure: 5 MAC 0030F4-D1127B
Frame number 379685
Internal Temperature 14.0°C

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**Tropical Depression
Frank - Aug 28, 2010**